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COMMUNITY WATER SUPPLY STUDY, PUEBLO COUNTY, COLORADO. STANDARD METROPOLITAN STATISTICAL AREA

Bureau of Water Hygiene
Denver, Colorado

June 1970

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COMMUNITY WATER SUPPLY STUDY

PUEBLO COUNTY, COLORADO

STANDARD METROPOLITAN STATISTICAL AREA

By

Bureau of Water Hygiene

Environmental Health Service

U. S. Public Health Service

DHEW Region VIII

June 1970

Denver, Colorado

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SUMMARY OF FINDINGS AND CONCLUSIONS

To investigate public water supply systems in the United States, the Bureau of Water Hygiene of the U.S. Public Health Service, with the cooperation of State and local health departments, and water utilities, conducted a nationwide Community Water Supply Study (CWSS) during 1969 in eight geographically distributed Standard Metropolitan Statistical Areas and the State of Vermont.

The study in Region VIII included 20 water supply systems serving about 111,500 people and was designed to assess: a) the status of drinking water quality, b) water supply system facilities, and c) bacteriological surveillance programs in urban and suburban areas in the high plains area region.

The following are the principal findings of the study:

A. Drinking Water Quality

1. To determine the quality of the drinking water in the 20 communities studied, samples were taken at various places in the distribution systems. The data were averaged for each system and constituent concentrations compared to bacteriological, chemical, and physical constituent limits of the 1962 U.S. Public Health Service Drinking Water Standards (DWS). On this basis:

a) Only ten percent of the systems delivered drinking water that did not exceed any of the constituent limits.

b) Additionally, 55 percent of the systems delivered drinking water that exceeded at least one of the DWS "recommended limits" (defined on page 13) but did not exceed any of the DWS "mandatory limits" (defined on page 14).

c) Finally, 35 percent of the systems delivered drinking water that exceeded one or more of the DWS mandatory limits.

2. The quality of drinking water in smaller and larger communities is summarized below:

	Less than 500 population (16 systems)	Greater than 500 population (4 systems)	All Systems (20 systems)
Did not exceed limits	6%	33%	10%
Exceeded recommended limits	56%	34%	55%
Exceeded mandatory limits	38%	33%	35%

3. While two systems (10 percent of the study total) delivered water whose quality on the average throughout the distribution system did not exceed the DWS limits, people do not drink the average water, they drink from a specific tap. Individual samples drawn from many of these systems contained constituents whose concentrations exceeded the DWS limits. Of the 49 individual samples taken throughout the study at the consumer's tap, which were essentially glasses of drinking water, 38 (77.6 percent) contained one or more constituents whose concentration exceeded the DWS limits. Each sample in the study had a population equivalent equal to the community population divided by the number of samples drawn in that community. On this basis the 38 glasses of drinking water containing substances that exceeded at least one DWS limit were being served to a population of 35,000 people, 31.25 percent of the study population.

B. Water Supply System Facilities

1. To determine the status of the facilities used to treat, distribute, and store public drinking water, site surveys and interviews with operators were conducted regarding the water supply system. Based on this information, 20 percent did not have any "major deficiencies" (see page 25), while 80 percent had one or more of the following major deficiencies, where applicable: inadequate source protection, inadequate disinfection and/or control of disinfection, inadequate clarification (removal of suspended matter) and/or control of clarification, and inadequate pressure in the distribution system.

2. Data based on system size are summarized below:

	Less than 500 population (16 systems)	Greater than 500 population (4 systems)	All Systems (20 systems)
No major deficiencies	13%	67%	20%
Some major deficiencies	87%	33%	80%

C. Bacteriological Surveillance Programs

1. To determine the status of the bacteriological surveillance program over each water supply system investigated, records in the State and county health departments were examined for the number of bacteriological samples taken and their results during the previous 12 months of record. Based on this information, only 10 percent had bacteriological surveillance programs that met the "criteria" (see page 27), while 90 percent either did not collect sufficient samples or collected samples that showed poor bacterial quality, or both.

2. The data on the adequacy of bacteriological surveillance programs related to system size are summarized below:

	Less than 500 Population (16 systems)	Greater than 500 Population (4 systems)	All Systems (20 systems)
Met criteria	6%	25%	10%
Did not meet criteria	94%	75%	90%

3. Even considering a sampling rate reduced by 50 percent of that called for in the criteria, 13 systems (65 percent of the study total) still would not have collected sufficient samples.

D. Other Major Findings and Conclusions

1. To determine the status of the programs to control health hazards, data were collected on the status of the cross-connection control program. This information indicated that cross-connection prevention ordinance, plumbing inspection programs on new construction, and re-inspection of existing construction were lacking in a vast majority of the water supply systems studied.

2. Size of community or system influences the quality of water delivered. Both operation and surveillance could be conducted more efficiently and for less cost if some regionalization of systems serving under 500 people could be accomplished.

RECOMMENDATIONS

The results of the Community Water Supply Study lead to four general recommendations:

1. Existing technology should be applied more often and more effectively.

2. County, State and Federal technical assistance and training programs should be expanded to upgrade the operation of systems.

3. Utility, State and local surveillance programs should be expanded.

4. Research in several areas where current scientific knowledge and technology is inadequate should be initiated.

Specific recommendations for action are:

1. Colorado Department of Health surveillance be improved. This improvement should consist of: 1/ a) sufficient bacteriological sampling, including check samples for positive results in accordance with the DWS, and b) annual visit to make a complete physical inspection or a sanitary survey of each system from source to consumer's tap.

2. Immediate follow-up of positive bacteriological analysis be made to determine the cause and correction of factors responsible for the unsatisfactory samples. Such factors as inadequate disinfection, new construction and cross connections should be considered. This procedure had not been followed by local interests.

3. Necessary improvements should be made in each system to insure that a safe and adequate water is delivered to the consumer.

4. A new water treatment plant be constructed for the Pueblo system or the present one renovated to meet Colorado Department of Health recommendations, which include filtration of a surface water source.

5. To improve water systems for the public through better maintenance and operation the following should be considered:

Formation of a regional or county water authority that will:

a) Consolidate districts
b) Establish workable rates to cover costs of equipment, maintenance, and payments of loans.
c) Employ full-time, competent maintenance personnel
d) Arrange for more frequent bacteriological and chemical analysis, perhaps operate a central laboratory.

1/ Manual for Evaluating Public Drinking Water Supplies, DHEW, PHS, CPEHS, No. 1820, 1969.

6. Investigations be expanded for the reduction of taste and odor problems in tap waters.

7. Safe yield for surface sources and maximum dependable draft for groundwater source be computed for each system where applicable so that planning and future expansion as well as daily reliability to meet demand is based on known capability of the source.

8. The presence of coliform organisms at a level above the DWS limit in eight (8) systems indicates that better source protection and/or disinfection should be instituted as soon as possible. Further laboratory and field testing should be conducted to determine the source of the contamination and the degree of chlorination or other disinfection necessary to control microbial forms throughout the distribution system without creating chlorinous tastes. More research should be done on determining the influence of residual organics on the development of tastes and organism regrowth in the distribution system.

9. The water utility should be responsible for water quality control, but the bacteriological surveillance collection requirements seem to be beyond the capability of most small water systems. A more practical technique must be developed if the public's health is to be protected. If all systems were chlorinated, a residual chlorine determination might be a more practical way of characterizing safety. Chlorine residual should be performed in the field whenever a bacteriological sample is collected because it gives an immediate indication of safety. Eventually an inexpensive continuous monitor should be developed and installed at the end of the system to reflect safeness at those weak points.

10. Because a consumer may reject a safe water if its appearance or taste is unsatisfactory, the many utilities with such constituents as iron, manganese, hydrogen sulfide, color, turbidity, algae and macroscopic organisms in their water should make every effort to use available treatment technology to reduce them. This could include such practices as mixing of raw water reservoirs, aeration, and/or coagulation and filtration. Further research is necessary to understand what causes these problems as well as how to more effectively remove them.

11. Inasmuch as tastes and odors remain a common complaint in public water supplies, more effort should be made to employ the present technology of oxidation and adsorption to control or remove these troublesome constituents. Further research is needed to reduce the cost of such treatment to make it more practical and acceptable. Better analytical procedures are needed to tailor the treatment to solve a specific problem. These analytical methods for organics would be valuable to toxicologists in determining the health effects of specific compounds as well as the general organics found in the water.

12. This study demonstrated a deterioration in quality after water left the treatment plant. The reason why trace metals and corrosion products continue to be present in tap water, in spite of efforts to prevent this corrosion, should be investigated. A continuous monitor for these constituents needs to be developed to determine more specifically where the problem originates. When the cause and effect relationship has been established, then corrective action can be taken.

13. Some of the drinking water standards were established with meager data on health effects. The CWSS results afford for the first time extensive data on drinking water quality at the consumer's tap and these data should be used for correlation studies with available health indices to see if the standards are adequate. Epidemiological field studies should be conducted in problem areas uncovered by the CWSS. Chemical data from the study should be used to estimate the portion of total body burden that is contributed by drinking water. The study, of course, only covered items in the drinking water standards, and data are not available on many other contaminants of drinking water, such as mercury.

14. Hazardous low-pressure areas were found in many water systems primarily because of deficient pumping, storage, and distribution facilities. An effort should be made to monitor pressure at the strategic locations of the system and install adequate pumps, reservoirs, and/or to strengthen the distribution network to handle peak fire or hot-weather demands. Such a program, along with the installation of backflow prevention devices, should minimize the danger from unfound cross-connections.

15. Because the one-time survey provided by the CWSS has resulted in improvements in some water supply systems, expanded State and local surveillance programs would probably continue to upgrade water supply systems. In most cases, however, county and State health departments involved in this study had budgets and staffs that are too small. On a national basis an estimated 14-million dollar increase in the State programs is needed to conduct the recommended water system inspection, sampling, bacteriological and chemical analyses, and to provide technical assistance to the individual utility operator. Additional money would be needed to conduct formal operator training.

16. Most of the operators have had no special water technology training. Further a substantial need exists for additional staff to provide expanded programs for quality control. Therefore the existing training programs of the utility, State, and Federal groups should be enlarged considerably to provide better skilled operators.

17. The frequent occurrence of water quality problems and facility deficiencies in small systems, makes consolidation or regionalization of services of some systems advisable. This would reduce the cost and improve the quality of the water delivered. As an initial effort surveillance services and technical assistance could be provided by one group for several separate systems. Preliminary to complete consolidation an attempt should be made to, at least, provide high quality treated water to scattered but nearby towns.

INTRODUCTION

The purpose of the Community Water Supply Study (CWSS) was to determine if the American consumer's drinking water met the Drinking Water Standards.* To obtain nationwide coverage the Bureau of Water Hygiene of the U.S. Public Health Service initiated the CWSS in February of 1969 in nine areas across the country. The field work for the CWSS was conducted by the Bureau of Water Hygiene in cooperation with the State and local health departments and the water utilities.

This study was designed to give an assessment of drinking water quality, water supply systems, and surveillance programs in urban and suburban areas in each of the nine regions of the Department of Health, Education, and Welfare. These areas were selected to give examples of the several types of water supplies in the country. A whole Standard Metroplitan Statistical Area (SMSA) was the basis of each study, except in Region I where the entire State of Vermont was included, with evaluations made on all public water supply systems, as defined herein, in each study area. This coverage allowed an assessment of the drinking water quality of the large central city, the suburbs, and the smaller communities located in the counties in the SMSA, and the interaction between them.

Specifically, the objectives of this study were accomplished by determining whether or not:

1. The quality of the urban and suburban American consumer's drinking water in the selected study areas exceeded the Constituent Limits of the Drinking Water Standards (DWS);*

2. The water supply systems supplying this drinking water to the consumers were essentially free from major deficiencies;

3. The bacteriological surveillance programs over these water supply systems meet the established criteria (see page 27).

The authority for the Community Water Supply Study is found in Title III, Part A, Section 301, Public Health Service Act, amended (42 U.S.C. 241).

> "Sec. 301 - The Surgeon General shall conduct in the Service, and encourage, cooperate with, and render assistance to other appropriate public authorities, scientific institutions, and scientists in the conduct of, and promote the coordination of, research, investigations, experiments, demonstrations, and studies relating to the causes, diagnosis, treatment, control, and prevention of physical and mental disease and impairments of man, including water purification. . ."

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* 1962 U.S. Public Health Service Drinking Water Standards, PHS Publication no. 956, Superintendent of Documents, U.S. Government Printing Office, Washington, D.C., 61 pp.

SCOPE

Public water supplies in the United States numbered 19,236 serving some 150,000,000 people when last inventoried in 1963.* The remaining 50 million people had private water supplies. Most of the public water supplies were small, about 85 percent serving 5,000 or less people. About one-half of the public was served by the 18,837 supplies that each served 100,000 or less persons and the other one-half (77 million) were served by the 399 larger supplies. About 75 percent of these public water supplies have ground water as a source, while 18 percent use surface water. The remaining 7 percent have a mixture of ground and surface water source.

Systems Studied

This study covered 20 public water supply systems, including 16 community water supply systems (80 percent of the total) and 4 special water supply systems (20 percent of the total). For this study the following definitions of the systems were used.

> PUBLIC WATER SUPPLY SYSTEM - A water supply system includes the works and auxiliaries for collection, treatment, storage, and distribution of water from the sources of supply to the free-flowing outlet of the ultimate consumer. Water supply systems were included in this study if they had 15 or more service connections and/or served 25 or more consumers.
>
> Special Water Supply Systems - those systems serving trailer and mobile home parks, other tourist accommodations, and institutions with resident populations.
>
> Community Water Supply Systems - all other systems studied in an SMSA.

The 20 public water supply systems studied served about 111,500 persons and consisted of 1,813 ground water systems, two surface water systems, one system with mixed sources, and four special water supply systems.

For the purpose of the report, water supply systems were divided into four types: 1) those using surface water or a mixture of surface and ground water as a source; 2) those using ground water as a source (this type was further divided into: a) wells, b) springs, and c) mixture of both; 3) those purchasing wholesale finished water as a source; and 4) special water supply systems. Table I shows the number of systems in each category and the population served in each region and in the entire study.

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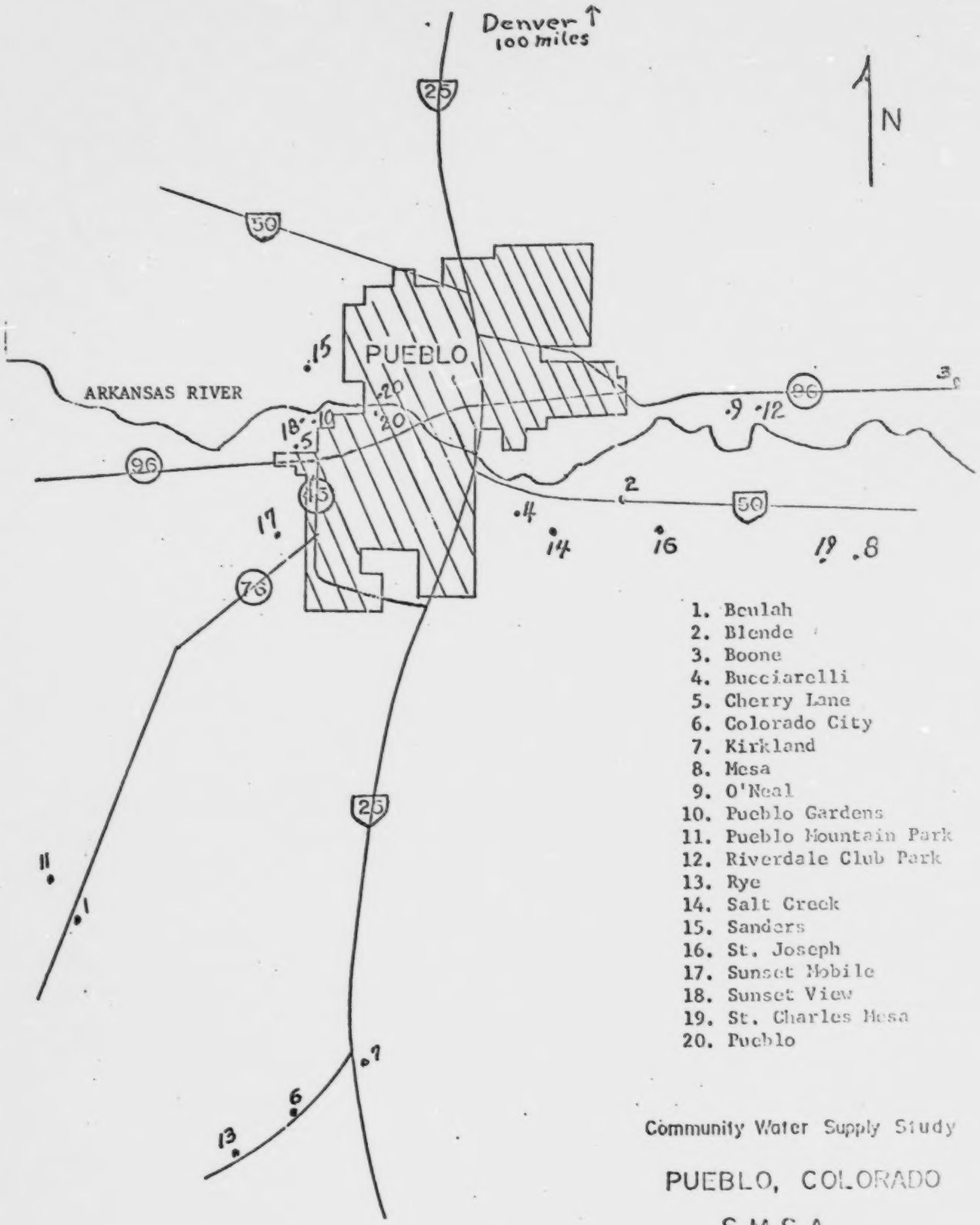
* Statistical Summary of Municipal Water Facilities in the United States, January 1, 1963; PHS Publication no. 1039, Government Printing Office, Washington, D.C., 1965, 66 pp.

TABLE I - SUMMARY OF WATER SUPPLY SYSTEM TYPES

Region	Popula-tion*	Number of Systems by Type						
		Surface & Mixed Source	Ground Source			Wholesale Finished Source	Special	Total
			Wells	Springs	Mixture of Both			
I	307.2	73	40	67	23	1	14	218
II	12,356.3	14	135	0	1	30	41	221
III	229.3	14	12	1	0	3	0	30
IV	251.1	1	16	0	0	3	2	22
V	1,366.0	8	31	0	0	19	8	66
VI	1,383.5	23	24	0	0	34	7	88
VII	1,085.4	7	14	0	0	2	3	26
VIII	111.5	4	11	1	1	0	3	20
IX	1,113.4	22	213	11	12	14	6	278
	18,203.8	166	496	80	37	106	84	969

*In thousands.



1. Beulah
2. Blende
3. Boone
4. Bucciarelli
5. Cherry Lane
6. Colorado City
7. Kirkland
8. Mesa
9. O'Neal
10. Pueblo Gardens
11. Pueblo Mountain Park
12. Riverdale Club Park
13. Rye
14. Salt Creek
15. Sanders
16. St. Joseph
17. Sunset Mobile
18. Sunset View
19. St. Charles Mesa
20. Pueblo

Community Water Supply Study

PUEBLO, COLORADO

S.M.S.A.

9-20-69

STUDY AREA

Background for selection of each of the nine study areas and the definition of Standard Metropolitan Statistical Area (SMSA) are given below.

> STANDARD METROPOLITAN STATISTICAL AREA - The boundaries and titles of standard metropolitan statistical areas are established by the Bureau of the Budget with the advice of the Federal Committee on Standard Metroplitan Statistical Areas. An SMSA is a county or group of contiguous counties which contains at least one city of 50,000 inhabitants or more or "twin cities" with a combined population of at least 50,000. In addition to the county, or counties, containing such a city or cities, contiguous counties are included in an SMSA if, according to certain criteria, they are essentially metropolitan in character and are socially and economically integrated with the central city.

Pueblo county is situated approximately 112 miles south of Denver in south central Colorado along the Arkansas River at a mean altitude of 4,690 feet. According to the 1969 Census the population is 125,200. The water supplies served totaled 112,587.

This SMSA is located near the major coal fields and many of the metal deposits of the State. It is also an important manufacturing center with the plant of Colorado Fuel and Iron Corporation, Colorado's largest industry employing 18,000 men in the mining and manufacture of steel and iron.

Water plays a vital role in Pueblo's economy. An arid region where natural rainfall averaging only 8 to 16 inches per year will not support conventional agriculture, the area depends on irrigation for a substantial part of its crop production.

The average temperatures for the area range from 35° in January to 77° in July. The growing season ranges from 150 to 180 days. The area also received 70 to 80 percent of possible sunshine throughout the year.

Summary Data on Supplies Studied in SMSA

Name of Supply	Type	Population	Average Daily Demand (mgd)	Source
Beulah	Community	500	0.075	Surface
Blende	Community	70	0.325	Well
Boone	Community	600	0.090	Combined
Bucciarelli	Community	150	-	Spring
Cherry Lane	Community	150	0.009	Well
Colorado City	Community	160	0.030	Wells
Kirkland	Special	50	0.009	Wells
Mesa	Special	350	-	Well
O'Neal	Community	250	-	Well
Pueblo*	Community	104,000	21.3	Surface
Pueblo Gardens	Community	50	0.002	Well
Pueblo Mtn. Park	Community	75-150	0.042	Combined
Riverdale Club Park	Special	120	-	Well
Rye	Community	600	0.050	Combined
Salt Creek	Community	600	0.216	Well
Sanders	Community	175	0.030	Well
St. Charles Mesa	Community	3,500	0.170	Wells
St. Joseph	Community	72	0.030	Well
Sunset Mobile	Special	15(19 services)	-	Well
Sunset View	Community	60	-	Well
	Total	111,622		

* For interstate carrier water supply

EVALUATION CRITERIA

Each water supply system was investigated on three bases: (1) drinking water quality was determined by sampling the finished and distributed water and returning these samples to the laboratories of the Bureau of Water Hygiene for bacteriological, chemical, and trace metal analyses, (2) the status of the water supply system facilities was determined by a field survey of the system and the gathering of data on three standard forms (four items were chosen to represent major problems: a) source(s), b) treatment, if any, c) distribution system pressures, and d) operation); (3) the status of the surveillance program over the water supply system was evaluated by obtaining bacteriological water quality data for the previous 12 months of record from State and county health department files.

Water Quality Criteria

Water quality was judged either:

1) Not to exceed the Constituent Limits of the DWS (hereafter called Does not exceed limits) or,

2) To exceed at least one "recommended" Constituent Limit (some are aesthetic parameters), but does not exceed any "mandatory" Constituent Limit (hereafter called Exceed recommended but not mandatory limits) or,

3) To exceed at least one "mandatory" Constituent Limit (hereafter called Exceed mandatory limits).

The limits for the constituents measured in this study are summarized in Table II below.

Table II - Partial List of Bacteriological, Chemical, and Physical Constituent Concentration Limits Taken from the 1962 U.S. Public Health Service Drinking Water Standards.

RECOMMENDED LIMITS (If the concentration of any of these constituents are exceeded, a more suitable supply or treatment should be sought)	
Constituent	Limit
Alkyl Benzene Sulfonate (Measured as methylene-blue-active substances)	0.5 mg/l
Arsenic	0.01 mg/l*
Boron	1.0 mg/l**

Table (Continued)

Chloride	250 mg/l
Color	15 Units
Copper	1.0 mg/l
Carbon-Chloroform Extract (CCE)	0.200 mg/l
Cyanide	0.01 mg/l
Fluoride	
Temp. (Ann.Avg.Max.Day, 5 yrs. or more)	
50.0-53.7	1.7 mg/l
53.8-58.3	1.5 mg/l
58.4-63.8	1.3 mg/l
63.9-70.6	1.2 mg/l
70.7-79.2	1.0 mg/l
79.3-90.5	0.8 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Nitrate	45 mg/l
Radium-226	3 uuc/l (pc/l)***
Strontium-90	10 uuc/l (pc/l)***
Sulfate	250 mg/l
Total Dissolved Solids (TDS)	500 mg/l
Turbidity	
Untreated	5 Units
Treated by more than disinfection	1 Unit
Zinc	5 mg/l

MANDATORY LIMITS

(If the concentration of any of these constituents are exceeded, the further use of this water for drinking and culinary purposes should be evaluated by the appropriate health authority because water of this quality represents a potential hazard to the health of consumers.)

Constituent	Limit
Arsenic	0.05 mg/l
Barium	1.0 mg/l
Boron	5.0 mg/l**
Cadmium	0.01 mg/l
Chromium (hexavalent)	0.05 mg/l
Coliform organisms (Measured by membrane filter technique)	Fails std. if: a) Arithmetic avg. of samples collected greater than 1/100 ml. b) Two or more samples (5% or more if more than 20 examined) contain densities more than 4/100 ml.

Table - (Continued)

Cyanide	0.2 mg/l
Fluoride	
Temp. (Ann.Avg.Max.Day,5 yrs or more)	
50.0-53.7	2.4 mg/l
53.8-58.3	2.2 mg/l
58.4-63.8	2.0 mg/l
63.9-70.6	1.8 mg/l
70.7-79.2	1.6 mg/l
79.3-90.5	1.4 mg/l
Gross Beta activity (in the absence of α or Sr-90)	1,000 uuc/l (pc/l)***
Lead	0.05 mg/l
Selenium	0.01 mg/l
Silver	0.05 mg/l

*Although the recommended arsenic concentration is 0.01 mg/l, because of interferences in some waters the concentration of arsenic was only determined to be less than 0.03 mg/l. For the purposes of this study, these waters were considered not to exceed the recommended standards.
**Proposed for inclusion in the Drinking Water Standards.
***If these limits are exceeded, refer to Section 6.2 of the DWS.

Facilities Criteria

Source, treatment, operation, and distribution facilities were judged either:

1) To be essentially free from major deficiencies, or
2) To have one or more of the following major deficiencies (where applicable)
   a) Inadequate source protection (in absence of disinfection or buying chlorinated water)
   b) Inadequate disinfection (if disinfection practiced)
   c) Inadequate control of disinfection (if practiced or if purchasing chlorinated water)
   d) Inadequate clarification capabilities (if clarification practiced)
   e) Inadequate control of clarification (if clarification practiced)
   f) Inadequate pressure ($<$ 20 psi) in some or all areas of the distribution system.

Bacteriological Surveillance Program Criteria

The bacteriological surveillance program over the water supply system was judged either:

1) To meet the following criteria or,
2) Not to meet one or both of the following
   a) Collection of the required number* of bacteriological samples for no less than 11 months during the previous 12 months of record.
   b) Passing the bacteriological quality standard* for no less than 11 months during the previous 12 months of record.

* See pages 3-6 of the Drinking Water Standards.

METHODS

Field Survey

The regional office staff, in cooperation with the State and local health department officials prepared a listing of all known water supplies meeting the definition adopted for this study. The list contained the supply name, address, name of the superintendent or person in charge, indication of size, and the telephone number. The list was cross-checked with community and subdivision names to eliminate duplication and establish those areas for which the water supply facilities were apparently unknown. A Form PHS-682, Report of Water Supply Used on Interstate Carriers, was prepared for each supply from State and local health department records. The completed list became the basis for work schedules for the field engineers.

Actual field surveys were made by one of the 20 PHS engineers from headquarters and the regional offices that made up the field staff. At the option of State and local health department staff members, they made surveys with the PHS engineer.

During the field survey the engineer completed Forms ECA-18, Inventory of Municipal Water Facilities, and ECA-19, Municipal Water Supply Sanitary Survey, to provide information on source; treatment; operation; laboratory control; personnel; distribution; surveillance practices; planning for improvements; and water rates. Examples of the standard forms are in the Appendix.

Sampling Program

The following samples were collected and dispatched to various Bureau of Water Hygiene laboratories:

1) Raw water
   One sample for bacteriological analysis.

2) Finished water ready for distribution
   Four or five samples for chemical analyses as follows:

   a) 2 1/2-gallon sample to the Northeast Water Hygiene Laboratory. This was a grab sample for most ground water and small surface water treatment plants, but where possible a 14-day composite was taken. The following analyses were made on this sample:

Arsenic	Cyanide	Sulfate
Boron	MBAS	TDS
Chloride	Nitrate	Turbidity
Color	Selenium	

b) 8-oz. aliquot sample for trace metals analysis was taken out of sample 2)a) above and sent to the Cincinnati laboratory. The following analyses were made on this sample:

Barium	Copper	Manganese
Cadmium	Fluoride	Nickel
Chromium	Iron	Silver
Cobalt	Lead	Specific Conductance
		Zinc

c) 1-gallon sample for radioactivity analyses was sent to one of the three Bureau of Radiological Health laboratories. It was collected in the same manner as sample 2)a) above. The following analyses were made on this sample:

Specific gamma emitting radionuclides (I^{131}, Cs^{137}, Ba^{140})
Gross Alpha
Gross Beta
Radium-226, if gross alpha exceeded 3 pc/l
Strontium-90, if gross beta exceeded 10 pc/l
Tritium - (run on 10% of samples)

d) 1-gallon sample for pesticide analysis to the Gulf Coast Water Hygiene Laboratory from surface water supplies plus those ground water supplies where sampling was specifically requested by the State or county health officials. It was collected in the same manner as sample 2)a) above. The following analyses were made on this sample:

Aldin	Dieldrin	Heptachlor Epoxide
Chlordane	Endrin	Lindane
DDT	Heptachlor	Methoxychlor
		Toxaphene

e) 1 activated carbon monitor sample to the Cincinnati Laboratory from 110 selected water supplies, 94 of which were from surface sources. Carbon chloroform extract (CCE) and carbon alcohol extract (CAE) concentrations were determined from this monitor.

3) Distribution System

Samples for bacteriological and trace metal analyses at the rate of 10 percent of the number required by Figure 1, of the DWS, with a minimum of two each from any water supply.

Laboratory Procedures

Bacteriological

All samples were collected in 8-oz. sterile, plastic, wide-mouth, screw-capped bottles which contained 0.2 ml of a 10 percent solution of sodium thiosulfate as a dechlorinating agent. This concentration of thiosulfate was sufficient to neutralize a sample containing about 15 mg/l residual chlorine, an amount above any residual that was present. Refrigeration of all samples was required during transportation back to the laboratory. Maximum time between collection and analysis did not exceed 30 hours. The bacteriological procedures were those of Standard Methods.*

The membrane filter (MF) procedure was used for total coliform detection in this study for three reasons. One, larger volumes (100-ml portions) of distributed water could be examined than with the MPN technique; two, the MF procedure yields more precise results; and three, less processing time would be involved per sample, so reexamination of many of the samples could have been made within the 30-hour time limit if required. All potable and source water samples were examined for total coliforms using M-Endo MF broth, incubated at 35°C for 20-24 hours. Because raw water quality varied with its source, three decimal sample portions were filtered, the volume being determined by the estimated water quality.

Any coliform colonies detected in the examination of a sample were further verified by transfer to phenol red lactose for 24- and 48-hour periods at 35°C incubation. All positive phenol red lactose broth tubes then were confirmed in brilliant green lactose at 35°C for verification of total coliforms and in EC medium at 44.5°C for detection of fecal coliforms. This procedure further confirmed the standard total coliform MF test and supplied additional information on the potentially hazardous occurrence of fecal in those potable water supplies.

Basic knowledge was also needed on the general bacterial population of potable water. Therefore the general population of bacterial count (plate count) was also made on all distribution system samples. Sample portions of 1 ml and 0.1 ml in plate count agar (Tryptone-Glucose-Yeast Agar), incubated 48 hours at 35°C were sufficient to yield the desired data.

Chemical

The five samples, as noted above, taken to determine the chemical quality of the finished and/or distributed water were analyzed as follows:

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*Standard Methods for the Examination of Water and Wastewater, 12th Ed., APHA, AWWA, and WPCF. American Public Health Assn. New York, 1965, 796 pp.

Sample 2)a), General Chemistry.

These constituents were generally determined by Standard Methods, except as listed below.

Barium

No standard method existed at the time this study was undertaken. An atomic absorption procedure, which will appear in the next edition of Standard Methods, was used and was found acceptable. The analysis was made only on those samples that had less than 2 mg/l because above that concentration the barium precipitates out of solution.

Chloride

A variation of the potentiometric titration procedure was used, which is a tentative method in Standard Methods, page 372. Rather than titrate with silver nitrate to a specified end-point in millivolts, using a glass electrode and a silver-silver chloride electrode, a standard curve was prepared that related millivolts to chloride concentration. The concentration of an unknown is then determined from the standard curve. The procedure was just as accurate as the titration method and was simpler to carry out.

Fluoride

A fluoride electrode method, which will appear in the next edition of Standard Methods, was used. Precision and accuracy was generally better than any other method and the method was simpler to carry out.

Sample 2)b), Trace Metals.

The atomic absorption spectrophotometer method was used for all heavy metals (cadmium, chromium, copper, iron, lead, manganese, silver, zinc, nickel, and cobalt) because its sensitivity, specificity, simplicity and speed of analysis far exceeded the usual wet chemical methods. An atomic absorption method for these metals will appear in the next edition of Standard Methods.

Sample 2)c), Radioactivity.

These radiological constituents were determined using standard radiological counting techniques.

Sample 2)d), Pesticides.

No standard procedure for pesticide determinations existed at the time the CWSS was undertaken. Gas chromatography is generally the accepted method of analysis and will appear in the next edition of Standard Methods. Therefore this technique was used.

Sample 2)e), Organics (CCE and CAE).

These organic constituents were determined using standard extraction techniques.

TABLE III - WATER TREATMENT PRACTICES IN THE SYSTEMS STUDIED

Treatment Practice	Type of System (Number of Systems of Each)						Overall System Totals	
	Surface Water & Mixed Source	Ground Water Source			Wholesale Finished Water Source	Special Systems	Number	Percent
		Springs	Wells	Mixture of Both				
Do not disinfect, clarify, or buy, chlorinated water	0	0	2	0	0	1	3	15
Disinfection only or buy chlorinated water	1	1	7	1	0	1	11	55
Clarification* and disinfection	3	0	2	0	0	1	6	30
Clarification* without disinfection	0	0	0	0	0	0	0	0
System Totals - Number	4	1	11	1	0	3	20	--

*Clarification is the removal of suspended material by coagulation, sedimentation and/or filtration.

TABLE IV - WATER TREATMENT PRACTICES IN THE SYSTEMS STUDIED

Treatment Practice	Population Served in Thousands (Number of Systems of Each)							Overall System Totals	
	< .5	.5-5	5-10	10-25	25-50	50-100	>100	Number	Percent
Do not disinfect, clarify, or buy chlorinated water	3	0	0	0	0	0	0	3	15
Disinfection only or buy chlorinated water	10	1	0	0	0	0	0	11	55
Clarification* and disinfection	3	2	0	0	0	0	1	6	30
Clarification* without disinfection	0	0	0	0	0	0	0	0	0
System Totals - Number	16	3	0	0	0	0	1	20	--

*Clarification is the removal of suspended material by coagulation, sedimentation and/or filtration.

TABLE V - WATER QUALITY EVALUATION BY SOURCE

	Type of System (All data are percent of System Totals)						Overall System Totals	
	Surface Water & Mixed Source	Ground Water Source			Wholesale Finished Water Source	Special Systems	Number	Percent
		Springs	Wells	Mixture of Both				
Essentially meet Constituent Standards	0	0	18	0	0	0	2	10
Do not essentially meet Constituent Standards	100	100	82	100	0	100	18	90
Exceeds one or more recommended Constituent Standard (some are aesthetic parameters)	75	0	55	0	0	67	11	55
Exceeds one or more mandatory Constituent Standard	25	100	27	100	0	33	7	35
System Totals - Number	4	1	11	1	0	3	20	--

Note: Three (3) percent of the study population was served drinking water that essentially met the Constituent Standards.

TABLE VI - WATER QUALITY EVALUATION BY COMMUNITY SIZE

	Population Served in Thousands (All data are % of Size Totals)							Overall System Totals	
	<.5	.5-5	5-10	10-25	25-50	50-100	>100	Number	Percent
Essentially meet Constituent Standards	6	33	0	0	0	0	0	2	10
Do not essentially meet Constituent Standards	94	67	0	0	0	0	100	18	90
Exceeds one or more recommended Constituent Standard (some are aesthetic parameters)	56	34	0	0	0	0	100	11	55
Exceeds one or more mandatory Constituent Standard	38	33	0	0	0	0	0	7	35
System Totals - Number	16	3	0	0	0	0	1	20	--

Note: Three (3) percent of the study population was served drinking water that essentially met the Constituent Standards.

TABLE VII - FACILITIES EVALUATION BY SOURCE

	Type of System (All data are percent of System Totals)						Overall System, Totals	
	Surface Water & Mixed Source	Ground Water Source			Wholesale Finished Water Source	Special Systems	Number	Percent
		Springs	Wells	Mixture of Both				
Essentially free of major deficiencies	0	0	18	100	0	33	4	20
Major Deficiencies	100	100	82	0	0	67	16	80
Inadequate source protection in the absence of disinfection or buying chlorinated water	0	0	9	0	0	0	1	5
Inadequate disinfection, if practiced	0	100	54	0	0	33	8	40
Inadequate control of disinfection, if practiced, or if buying chlorinated water	0	0	9	0	0	0	1	5
Inadequate clarification, if practiced	25	0	0	0	0	0	1	5
Inadequate control of clarification, if practiced	50	0	0	0	0	0	2	10
Low (≤20 psi) pressure in some or all areas of the dist. system	100	100	45	0	0	33	11	55
System Totals - Number	4	1	11	1	0	3	20	--

TABLE VIII- FACILITIES EVALUATION BY COMMUNITY SIZE

	Population Served in Thousands (All data are % of Size Totals)							Overall System Totals	
	<.5	.5-5	5-10	10-25	25-50	50-100	>100	Number	Percent
Essentially free of major deficiencies	13	67	0	0	0	0	0	4	20
Major Deficiencies	87	33	0	0	0	0	100	16	80
Inadequate source protection, in the absence of disinfection or buying chlorinated water	6	0	0	0	0	0	0	1	5
Inadequate disinfection, if practiced	44	33	0	0	0	0	0	8	40
Inadequate control of disinfection, if practiced, or if buying chlorinated water	0	33	0	0	0	0	0	1	5
Inadequate clarification, if practiced	0	0	0	0	0	0	100	1	5
Inadequate control of clarification, if practiced	13	0	0	0	0	0	0	2	10
Low (<20 psi) pressure in some or all areas of the dist. system	63	0	0	0	0	0	100	11	55
System Totals - Number	16	3	0	0	0	0	1	20	--

TABLE IX - SURVEILLANCE EVALUATION BY SOURCE

	Type of System (All data are percent of System Totals)						Overall System Totals	
	Surface Water & Mixed Source	Ground Water Source			Wholesale Finished Water Source	Special Systems	Number	Percent
		Springs	Wells	Mixture of Both				
Meets bacteriological surveillance criteria	25	0	9	0	0	0	2	10
Does not meet bacteriological surveillance criteria	75	100	91	100	0	100	18	90
Does not meet collection portion of the bacteriological surveillance criteria	75	100	91	100	0	100	18	90
System Totals - Number	4	1	11	1	0	3	20	--
Do not take ½ enough samples - No.	2	0	9	1	0	1	13	

TABLE X - SURVEILLANCE EVALUATION BY COMMUNITY SIZE

	Population Served in Thousands (All data are % of Size Totals)							Overall System Totals	
	<.5	.5-5	5-10	10-25	25-50	50-100	>100	Number	Percent
Meets bacteriological surveillance criteria	6	0	0	0	0	0	100	2	10
Does not meet bacteriological surveillance criteria	94	100	0	0	0	0	0	18	90
Does not meet collection portion of the bacteriological surveillance critera	94	100	0	0	0	0	0	18	90
System Totals - Number	16	3	0	0	0	0	1	20	--
Do not take ½ enough samples - No.	10	3	0	0	0	0	0	13	

DISCUSSION

The results of this brief survey should be viewed as an indication of the condition of water supplies in the Pueblo County area at the time of the survey.

Bacteriological and chemical quality of water as it reaches a consumer's faucet may vary from week to week, even from hour to hour. Based on the results of the survey, a feasibility study should be made in order to implement a program to eliminate those constituents which exceed the Drinking Water Standards.

A significant approach to improvement of the operation of a water system is the employment of well-trained operators. Training in this field can be obtained from several sources including the American Water Works Association and by attendance at the annual Rocky Mountain Water and Waste Water School. Certification of the operator is highly desirable. Information on certification will be provided by the State Department of Health upon request. Another facet of the problem is that many of the systems are so small that the supply is unable to secure the services of a full-time water works operator. This is most unfortunate in that it usually results in improper maintenance and operation carried on in a "hit or miss" manner.

It should be a major concern to all that a safe water supply is a part of our environment. However water supply is neglected due to concerted publicity about schools, roads, water and air pollution which are, of course, important in our economy. Often it has been said that there is not sufficient money to improve the water supply system. If people are informed of the condition of their system and are sufficiently aroused, improvements can be made.

The relatively dry Colorado climate, coupled with high erosion rates and turbid water, has made the extraction of ground water popular to many smaller communities.

Unfortunately geology and mineralogy have not been kind to water consumers as many of the principal aquifers bear highly mineralized water. High total dissolved salts, sulfates, hardness and iron are quite general throughout the area covered by the survey. Besides the obvious objectionable physical characteristics--taste, hardness, and occasionally odor--high mineral content with relatively low pH (6.9-7.2) makes many of the waters very corrosive.

Selenium is one element making water unacceptable by PHS Standards.

The best ground water sources, chemically, are shallow. Several systems tap water from wells 35 to 50 feet deep. The filtering efficiency of the unconsolidated sediments overlying these aquifers has kept them generally free of bacterial contamination. They should, however, bear close watching to retard future chemical pollution from industrial waste disposal practices.

The deficiencies so common to ground water source monitoring and management in other regions are also present in Pueblo County. There is a general lack of reliable information on the construction features of the wells and the water-bearing formations tapped in each case.

Although the community in most cases is completely dependent on the well to sustain service, monitoring of the aquifer, the well, and the pumping equipment is usually totally absent. Information on static water level, dynamic water (pumping) level, specific capacity, well efficiency, and trends is generally lacking. The purveyors keep few records on the above and are, therefore, continually exposed to the hazard of "surprise" well and pumping equipment failures with consequent interruption of service. Since many small communities relying on ground water sources also depend on pressure tanks, any failure at the source results in an immediate loss of service to the consumer.

The State and the County should be encouraged to strengthen their control over ground water resource development, exploitation, and protection.

Bacteriological Evaluation

Three basic considerations were used in the evaluation of bacteriological data. They included (1) sufficient number of samples collected and analyzed during the past year, (2) results of these analyses, and (3) results of bacterial sampling during the survey. These evaluations are listed in Appendix A, Bacteriological Evaluation of Finished Water.

1. The outstanding conclusion that can be deduced from the tabulated data is that only two of the twenty systems surveyed are complying with the Drinking Water Standards regarding the recommended number of samples to be collected (frequency) and analyzed from the distribution system. This is applicable to all population groups and is particularly serious for the smaller systems ($< 1,000$). The number of months that sufficient samples were not collected, and the bacteriological results, indicate that the small systems are not meeting the standards.

2. If the samples collected during the survey were representative, then six (6) of the twenty systems would be unsatisfactory with nine (9) systems showing positive results.

Waterborne Disease

The Colorado Department of Health does not have any records of waterborne outbreaks in Pueblo County during the period 1960-69.

Consumer and Operator Comments

Taste of water

(Low) water pressure, caused when operator forgets to turn on pump to fill big water tank.

Customers do not pay water bills.

Insufficient funds to operate properly.

Occasionally for hardness.

Need new equipment, some as old as 1888.

High bills, low pressure, tastes and odor infrequently due to algae.

Low pressure

Not enough water

Lack of water during dry periods

Water too warm

Odor of sulfur

Occasional complaint from customers on sulfur odor from hot water tank.

No water available when pump breaks down and is not fixed for about one week.

Severe corrosion

Low pressure at end of line

APPENDIX A

ADDITIONAL DESCRIPTIVE MATERIAL

SUMMARY TABLE OF WATER SUPPLY SYSTEMS

Name	Population Served	Type of Supply	Major Deficiency(ies)	Remarks
Mesa	350	Special	None	One of the three samples exceeds the recommended iron standards.
Beulah	500	Community	Avg. iron exceeds recommended std.	Max. manganese was 0.18 mg/1
Blende	70	Community	Avg. coliform density (2/100 ml) exceeds mandatory standard.	Avg. chromium equals mandatory std.
Boone	600	Community	Avg. coliform density (4/100 ml) exceeds mandatory standard.	
Bucciarelli	150	Community	Avg. total chromium exceeds mandatory std.	
Cherry Lane	150	Community	Avg. selenium (0.02 mg/1) exceeds mandatory standard.	
Colorado City	160	Community	Avg. manganese (0.14 mg/1), sulfate (350 mg/1), and TDS (824 mg/1) exceed recommended standards.	One of the three samples exceeded the mandatory chromium standard.
Kirkland	50	Special	Avg. radium-226 (76.5 uuc/1) markedly exceeds recommended std.	

SUMMARY TABLE OF WATER SUPPLY SYSTEMS

Name	Population Served	Type of Supply	Major Deficiency(ies)	Remarks
O'Neal	250	Community	Avg. total chromium* (0.07 mg/1) selenium (0.06 mg/1) and lead (0.07 mg/1) exceeds mandatory stds.	Also, unacceptable frequency of bacteriological sampling.
Pueblo Gardens	50	Community	Avg. manganese (1.90 mg/1) markedly exceeds recommended standard.	Also, unacceptable frequency of bacteriological sampling.
Pueblo Mtn. Park	75-150	Community	Avg. coliform density (6/100 ml) exceeds mandatory standard.	
Pueblo Water (City)	104,000	Community	No filtration of surface supply.	Avg. iron and manganese conc. slightly exceed recommended stds.
Riverdale	120	Special	Avg. fluoride (1.9 mg/1) exceeds mandatory standard.	One of the three samples exceeded and the avg. conc. equalled the mandatory chromium standard.*
Rye	600	Community	Avg. Radium-226 (136 uuc/1) markedly exceeds recommended standard.	One sample out of three had an iron conc. of 6.1 mg/
Salt Creek	600	Community	The avg. fluoride (1.5 mg/1), sulfate (470 mg/1), TDS (880 mg/1), Radium-226 (5 uuc/1), and iron (2.27 mg/1) exceed the recommended standards.	

SUMMARY TABLE OF WATER SUPPLY SYSTEMS

Name	Pop. Served	Type of Supply	Major Deficiency(ies)	Remarks
Sanders	175	Community	Avg. fluoride (1.8mg/1), sulfate (310mg/1), TDS (708 mg/1), Radium-226 (5 uuc/1) and iron (0.40 mg/1) exceed recommended standards.	Also, unacceptable frequency of bacteriological sampling.
St. Joseph	72	Community	Avg. fluoride (1.6 mg/1) exceeds the recommended standard.	The avg. selenium conc. equalled the mandatory std. as did one of the three chromium samples.
St. Charles Mesa	3,500	Community	Unacceptable frequency of bacteriological sampling.	
Sunset Mobile	15 (10 services)	Special	Unacceptable frequency of bacteriological sampling, also avg. fluoride (1.3 mg/1), sulfate (710 mg/1) and TDS (1700 mg/1) exceed the recommended std.	
Sunset View	60	Community	Unacceptable frequency of bacteriological sampling, also avg. manganese (0.38 mg/1) exceeds the recommended std.	

*For the purposes of this study, total chromium was considered hexavalent chromium.

BACTERIOLOGICAL EVALUATION OF FINISHED WATER

Communities	12 Months of Record						Survey Results			
	No. Samples Required	No. Samples Collected	Rating	No. Mos. Samples Collected	No. Mos. Samples Unsat.	Rating	No. Samples Collected	No. Unsat.	Residual Chlorine	Rati
Pop. < 1,000										
Beulah	24	28	S	12	0	S	3	0	0	S
Blende	24	24	S	12	12	U	2	1	0	U
Boone	24	22	S	10	0	S	2	2	0	U
Bucciarelli	24	26	S	12	1	S	2	1	0	U
Cherry Lane	24	24	S	12	0	S	3	0	0	S
Colorado City	24	13	U	11	0	S	3	0	0	S
Kirkland	24	13	U	11	6	U	3	1	0	S
O'Neal	24	10	U	10	0	S	2	1	0	S
Pueblo Gardens	24	9	U	9	0	S	2	0	0	S
Pueblo Mtn. Park	24	11	U	11	3	U	2	2	0	U
Riverdale Club	24	10	U	10	0	S	3	0	0	S
Rye	24	25	S	11	4	U	4	3	0	U
Salt Creek	24	19	U	7	0	S	2	0	0	S
Sanders	24	10	U	10	0	S	3	1	0	S
St. Joseph	24	9	U	9	1	U	3	0	0	S
Sunset Mobile	24	10	U	10	0	S	3	0	0	S
Sunset View	24	9	U	9	2	U	2	1	0	U
Pop. 1,000 - 5,000										
St. Charles Mesa	48	22	U	10	0	S	3	0	0	S
Pop. > 5,000										
Pueblo	1200	1854	S	12	0	S	10	0	0→0.8	S
Mesa Soft Water	12	8	U	8	0	S	2	0	0	S

BACTERIOLOGICAL QUALITY

Supply	Total Plate* Count	Total* Coliform	Fecal* Coliform	Residual Chlorine (mg/l)	pH
Beulah	31	0	0	0	
	190	0	0	0	7.1
	2500	0		0	7.1
Blende	4200	0			7.2
	840	3	0		7.2
Boone	590	7	4	0	7.8
	75	1	0		7.8
Bucciarelli	250	0	0		7.5
	370	0	0		7.2
Cherry Lane	24	0	0	0	7.5
	23	0	0	0	7.6
	27	0	0		7.5
Colorado City	5500	0	0	0	7.0
	200	0	0	0	7.0
	120	0	0	0	7.0
	1700	0	0	0	7.5
	1000	0	0		7.5
	1000	1	0		
Mesa	420	0	0	0	8.0
	400	0	0	0	8.0
O'Neal	7	0	0	0	7.0
	740	82	0	0	
Pueblo Gardens	710	0	0		7.2
	5	0	0		7.2
Pueblo Mountain Park	57	7	6	0	7.0
	42	5	4	0	7.0
Riverdale	470	0	0	0	7.2
	1400	0	0	0	7.2
	1100	0	0	0	7.2

* per 100 ml. sample

BACTERIOLOGICAL QUALITY

Supply	Total Plate* Count	Total* Coliform	Fecal* Coliform	Residual Chlorine (mg/l)	pH
Rye	6	1	1	0	6.5
	29	1	0	0	6.5
	48	0	0	0	6.5
	1200	120		0	6.9
Salt Creek	4400	0	0	0	7.2
	5000	0	0		
Sanders	43,000	0	0	0	7.2
	49,000	0	0	0	7.2
	250	0	0	0	6.8
St. Charles Mesa	3	0		0.1	7.4
	440	0	0		7.6
	140	0	0	0	7.7
St. Joseph				0	7.2
				0	7.2
				0	7.2
Sunset Mobile	78	0	0	0	7.2
	11	0	0		7.2
	280	0	0		7.2
Sunset View	62	2	0	0	7.2
	100	0	0		7.0
Pueblo Water Works					7.5
	3700	0	0	0	7.2
	49	0	0	0	7.2
	2	0	0	0.5	7.0
	9	0	0	0	7.0
	61	0	0	0.3	7.0
	8	0	0	0.1	7.2
	7	0	0	0.6	7.0
	2	0	0	0.25	7.0
	65	0	0	0	7.0
	16	0	0	0.8	7.0

*per 100 ml. sample

RADIOLOGICAL RESULTS

Location	Serial No.	I-131	CS-137	BA-140	Alpha	Beta	RA-226	SR-89	SR-90
Beulah	3436	GAMMA	SPECT	NEG	LT(2)	5			
Blende	3330	GAMMA	SPECT	NEG	2	6			
Boone	3342	GAMMA	SPECT	NEG	5	5	.4		
Cherry Lane	3308	GAMMA	SPECT	NEG	9	7	.1		
Kirkland	3323	GAMMA	SPECT	NEG	164	73	76.5	NO	CHEM
Pueblo Mountain Park	3339	GAMMA	SPECT	NEG	2	4			
Riverdale	3335	GAMMA	SPECT	NEG	5	12	1.7	LT(5)	LT(2)
Rye	3126	GAMMA	SPECT	NEG	377	154	135.9	NO	CHEM
	3395	GAMMA	SPECT	NEG	LT(2)	5			
Sanders	3398	GAMMA	SPECT	NEG	21	26	4.6	LT(5)	LT(2)
St. Charles Mesa	3301	GAMMA	SPECT	NEG	LT(2)	4			
St. Joseph	3333	GAMMA	SPECT	NEG	13	11	.2	LT(5)	LT(2)
Sunset Mobile	3120	GAMMA	SPECT	NEG	14	42	2.2	LT(5)	LT(2)
Pueblo	3115	GAMMA	SPECT	NEG	LT(2)	5			

V. FACILITIES APPRAISAL

COMMUNITY	SOURCE			TREATMENT			DISTRIBUTION		
				DISINFECTION					
	Quantity	Protection	Rating	Capacity	Auxiliary	Rating	Storage	Pressure	Rati
Pop. < 1,000									
Beulah	A	A	S	A	None	U	A	I	U
Blende	A	I	U	U	None	U	A	I	U
Boone	A	A	S	A	None	U	A	A	S
Bucciarelli	A	A	S	A	None	U	A	I	S
Cherry Lane	A	I	U	A	None	U	I	A	U
Colorado City	A	A	S	None	None	U	A	A	S
Kirkland	A	A	S	I	None	U	A	A	S
O'Neal	A	A	S	A	None	U	I	A	U
Pueblo Gardens	A	I	U	A	None	U	I	A	U
Pueblo Mountain Park	I	I	U	A	None	U	A	I	U
Riverdale Club	A	A	S	A	None	U	A	A	S
Rye	A	?	S	A	A	S	A	A	S
Salt Creek	A	A	S	A	None	U	A	A	S
Sanders	A	I	U	?	None	U	A	A	S
St. Joseph	A	A	S	A	None	U	A	A	S
Sunset Mobile	A	A	S	A	None	U	A	I	U
Sunset View	A	I	U	None	None	U	A	I	U
Pop. 1,000-5,000									
St. Charles Mesa	A	A	S	A	A	S	A	A	S
Pop. > 5,000									
Pueblo	A	I	S	A	A	S	A	A	S

A - Adequate I - Inadequate S - Satisfactory U - Unsatisfactory

APPENDIX A

BRIEF DISCUSSION OF EACH SYSTEM

A. Community Supplies

Beulah

This water supply system serves about 130 families; about half of them are seasonal (summer) residence only. The system has a small treatment plant consisting of coagulation, floculation, sedimentation, rapid sand filtration, and chlorination. The day on which the survey was conducted the raw water entering the plant was very turbid due to heavy rainfall which washed sediment into the stream source.

This source is located on Middleton Stream and appears to be well protected from the general public in that only a few people who have mountain cottages are allowed in the general area of the source. The one big problem with this system was its distribution lines. The biggest line is only four inches in diameter and during the summer months lawn watering restrictions consist of allowing one side of the street water only every other day.

Overall the system is in good shape from a maintenance standpoint. The treatment plant is only a few years old and is in excellent condition.

Blende

This water supply and distribution system is privately owned and serves approximately 30 taps with a population estimated at 70.

The water source is a well adjacent to the Arkansas River. The well is in a large concrete pit which also houses the pump. Chlorination facilities are provided in a separate house adjacent to the main line going to distribution and to a 230,000 gallon steel standpipe. Although chlorination is provided, it does not appear to be adequate or controlled appropriately. No chlorine residual was detectable in a water line which was 3 to 5 feet from the chlorination or in the system itself. The operator does not keep any records (bacteriological or otherwise). This is not a revenue-producing waterworks and thus receives little upkeep.

Ground water level is just below the bottom of the concrete pit. A channel in the bottom of the pit, from where the water is pumped, is subject to contamination by flood water, insects, rodents, dirt, etc

It has been reported by the State that other wells in the area are cross-connected with the distribution system.

The steel standpipe is old and leaking from holes in its sides.

Boone

This system serves about 600 people in the town. Its source consists of 12 wells and 15 springs. It was not possible to get very close to the source due to mud causing the area to be inaccessible. From a distance, however, it appeared they were well protected. The system had an adequately protected clear well and provided chlorination. However no chlorine residual was detectable in any part of the distribution system. The system has a good bacteriological record. However it does have a relatively high concentration of selenium. It would, therefore, appear that a more desirable source should be obtained.

Water flows by gravity from the springs through asbestos cement pipe to a 95,000 gallon concrete ground level reservoir. Well water is pumped into a separate line going directly to the reservoir. The wells are not used during the winter months as the pumphouses and lines are not protected against freezing.

Bucciarelli

This water supply is sometimes called the Salt Creek (Western) supply. There are approximately 45 taps on the system.

Springs, ground water traveling through shallow formations and emerging on slopes near the river, provide the source for this supply. There is a catchment structure at roadside made of reinforced concrete approximately 8 by 8 feet wide and 8 feet deep, water tightness unknown. The operator reports a tile field embedded in gravel and covered by tar paper and natural earth fill, about 3 feet deep, materials from the area. Natural filtering efficiency is unknown. The spring area is not fenced allowing free access by people and animals. Homes with septic tank sewage disposal are known to be upgrade from the source.

Hypochlorination is practiced but the operator has no means of measuring its effectiveness. On the day of the survey no chlorine residual was detectable at two points in the distribution system nor at the point nearest the chlorinator.

Cherry Lane

This water company is a small supply which serves about 38 to 40 families. The source of supply is one well about 29 feet deep and is adequately sealed so as to prevent surface contamination from entering the well. It has a pressurized storage tank with a capacity of 8500 gallons.

The system has safe records as far as bacteriological contamination is concerned. Chlorination is provided, however, no chlorine residual was detected in the system or in the transmission line next to the chlorinator.

Colorado City

This is a small growing community with approximately 70 taps which should increase fairly rapidly. They have two deep wells but are using only one at the present time. Two wells top the Dakota sandstone formation, presumably the same layers, although one well produces about four times as much as the other. Bad weather had made the access road to the wells impossible. Storage for the system is more than ample for the present and foreseeable future needs. There is no treatment at present, although it was indicated that State suggestions for chlorination will be heeded in the near future.

O'Neal

The source is a well approximately 47 feet deep. Details of the well construction were not available. Three pumps are installed in the well, two "deep-well turbine" pumps and one submersible pump are all hooked into the system. The pump installation is makeshift, and the well is open at the top. However the well and chlorinator are enclosed in a building. The door was not locked on the day of the inspection.

High selenium (.061 ppm) makes rejection of the water mandatory. The water is also exceedingly high in sulfates, total salts, and total hardness. System pressure appears to be adequate.

System ownership is a trust with individual responsibility for operation not clear.

Pueblo Gardens

This system has bout 14 taps and serves about 50 people. It consists of one 30 feet deep drilled well. The well is located in a pit where water can easily collect (was filled with water on day of inspection), and although the well casings seem to be surrounded by grouting, it still does not appear to have a sufficient sanitary seal. The well is also located in the flood plain of the Arkansas River about 300 feet from the river proper. Chlorination is provided on a seasonal basis only. It was not in effect the day of the inspection even though the local health department suggested chlorination should be provided in the summer months.

It should also be noted that the well is located in a pasture where half-dozen horses roam. Although there is a concrete box around the well pit proper, horse manure was all around the area of the concrete box. It is conceivable that surface runoff could seep under the concrete box into the well pit.

No records were available from the operator although the local health department records indicate a safe bacteriological result for the past year.

Pueblo Mountain Park

The South Creek is the principal source of water, supplemented during severe dry periods by a hand-dug well about 50 feet from the stream and a sump. Stream water filters through an artificial fill behind a concrete dam. Filtering efficiency of the fill material and the ground around the well and sump is unknown. Well construction appears to be good for this type of structure.

The water is chemically excellent, being soft, low in mineral content and devoid of toxic minerals. Storage tanks appear to be well protected. This system has been in service for many years. Water consumption is continuously restricted, washing of cars and irrigation being prohibited.

Rye

This system has about 150 services and serves approximately 600 people. Its source is one artesian well, 1,430 feet deep. It has a new treatment plant which includes iron removal, a pressurized sand filter, and chlorination. The treatment plant itself is in excellent condition (new) and the operator keeps very good records of day to day operations on chemical use, chlorination and iron removal. The raw water is very high in iron, 5 to 10 ppm. The finished water has a count of 0 to 0.38 ppm. The well is adequately protected from surface contamination except for a vent pipe from the well casing which should be covered with a screen.

The system has a good bacteriological record and adequate storage facilities (storage tank is new also, approximately 300,000 gallons).

Salt Creek Water Association

This system serves about 150 families and has an artesian well (1500 feet deep) as its source. The raw water is very high in iron (5 to 10 ppm) content. The water treatment consists of iron removal, pressure sand filter, and chlorination. Their records show that the finished water has an iron content of 0 to 0.01 ppm. The plant is

new and is in excellent condition. However because they have only prechlorination, it is very difficult to pick up a chlorine residual.

Sanders

This is a small supply which serves about 50 families in one of the lower socioeconomic sections of the city of Pueblo. The supply has approximately 31 taps and is served from an approved well 900 feet deep. The water is pumped by a submersible pump through a pressure sand filter and into an approved ground concrete tank which has a capacity of 32,400 gallons. Another ground concrete tank, approximately the same capacity, has been constructed but has not been completed. The well house and clear well are located in a pasture where horses roam. There is also a log of salvage material stored or thrown all around this immediate area giving the appearance of a junk yard. The overflow pipe from the clear well is not screened and is in the pen where small animals can easily enter the well.

The chlorinator was not hooked up nor working and from the looks of things had not been operating in some time. The owner and operator had no records available on bacteriological or chemical analysis and did not seem to have much of an interest in the system except that it helps provide some profit to him. That is, he provided water to the homes he rented and tried to sell in this ghetto area of the town.

St. Joseph

This is a relatively new system about seven years old. It serves about 72 people in a new subdivision of approximately 18 homes. The source consists of one 50 foot drilled well and is adequately protected from surface contamination. The system is designed to take care of 100 homes, thus there is plenty capacity throughout the system. The storage is adequate and the well has a maximum dependable draft of 720,000 gallons.

Chlorination is provided to the water entering the storage tank (30,000 gal.) however no chlorine residual was detectable in the transmission line or the distribution system.

Sunset View

The well supplying this system is located below a community in the valley near the Arkansas River. Depth is not known but assumed to be shallow, possibly less than 50 feet. Casing is galvanized sheet metal, riveted. Other details of the construction are not known. A below-ground discharge line to an unprotected pit housing valves poses a possible entrance for contamination of the well since the pit is contiguous to the well casing and there is no provision for

drainage. The immediate well area is enclosed within a barbed wire fence, locked. The well cover is locked. There is a possible threat of flooding from the river.

No treatment is provided.

Storage within steel pressure tanks is at the base of the hill and enclosed in a locked building. Acceptable pressures were found on the days of the survey, but the management admits there are pressure problems during hot dry periods when there is abuse of the system by excessive irrigation draft. The water is high in manganese (0.382 ppm).

St. Charles Mesa Water Supply

This sytem is supplied by three wells tapping shallow formations, 35 to 40 feet deep. One of the wells at the treatment plant receives recharge from slow sand filtration through two 90 by 90 feet recharge basins complete with underdrain system. This recharge water runs directly into the well. Water for recharge comes from the Bessemer Irrigation Ditch. This recharge is affected during two periods of each year, February to May and September to November, depending on several factors: quality of the ground water, level of ground water, and the physical and chemical quality of the recharge water.

There is no way to sample the infiltrated recharge water for quality nor for rate of recharge.

Pueblo

The City of Pueblo system serves approximately 104,000 consumers. The source of water is the Arkansas River. Treatment consists of settling in large basins with addition of chemicals for floculation and settling. There are no filters.

Several deficiencies of the Pueblo water supply stand out in particular: (1) the Arkansas River as a source without filtration is unsatisfactory; (2) two aspects of the present treatment facilities are inadequate, namely the open finished water reservoir and short circuiting in the settling basin; and (3) demands are approaching plant output, particularly when raw water quality complicates treatment and overloads the plant.

Several other aspects of the supply should be mentioned. Maintenance is outstanding and the treatment plant chemist is extremely competent and knowledgable regarding his raw water characteristics and treatment capabilities.

However a combination of deficiencies, i.e., high demands, short circuiting in settling basins, no filters, and a highly polluted source is too much a possibility. Definite plans should be formulated to correct these deficiencies.

B. Special Supplies

Mesa

This water supply is owned and operated for water haulers. The water is pumped from a well 34 feet deep directly to tanks on trucks. The 18-inch galvanized casing terminated approximately six inches above the concrete floor but is not sealed around the plate supporting the pump. Chlorination facilities are provided but not always operated.

Riverdale Club Park

A well 2,052 feet deep supplies this sytem. Water temperature is about 88° F. It is artesian, flowing free at about 20 gpm. The well appears to be well protected. The pump and treatment buildings are well constructed and orderly. High selenium concentration (.022 ppm.) makes rejection mandatory. The water is also extremely high in sulfates (1543 ppm.), total salts (2897 ppm.) and total hardness (1650 ppm.). Nitrates are also high (63 ppm.) and the sodium concentration (236 ppm.) may make it undesirable for certain people. Bacteriological history is good.

Sunset Mobile

Beyond the assertion that this system is supplied by a "deep well," very little is known about the well's construction. There are no apparent toxic elements which would require rejection of the water. However it is high in sulfates (710 ppm.), total salts (1703 ppm.) and iron (0.34 ppm.).

Softening process is followed by pressure filtration. The chlorinator was inoperative on the day of the visit. Treatment equipment, well and storage are well protected within a locked building.

Of the 19 connections to the system, only seven were in use. The park does not appear to be a popular location for mobile homes. The operator seemed discouraged and showed little interest in the system. One customer complained, to the surveyors, of bad tasting water.

Kirkland

This is a small supply which serves about 12 trailers and two restaurants. Its source consists of two deep wells (477 and 500 feet) and

J47<

its treatment includes iron removal and disinfection. One well has been ordered shut down by the State because of high radiochemical test results. At the present time only one well is in use and it is now being tested for radiochemical contamination. The well appears to be adequately protected from surface contamination.

APPENDIX B

FORMS USED TO GATHER DATA

FC-18 (PHS)
(2-69)

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
Public Health Service
Consumer Protection and Environmental Health Service
Environmental Control Administration
Bureau of Water Hygiene

INVENTORY OF MUNICIPAL WATER FACILITIES

STATE

LATEST DATA IN PHS FILES | CURRENT DATA

COMMUNITY	POPULATION: ESTIMATED POPULATION SERVED	YEAR OPER. STARTED: PRESENT SUPPLY	PRESENT TREATMENT PLANT	OWNERSHIP
1	2	3		4

COMMUNITY OR FACILITY LOCATION (1) a: Correct legal name

Postal address of utility

COUNTY (1) b

1960 CENSUS POPULATION (2) a

CURRENT ESTIMATED POPULATION SERVED (2) b

LAB. CONTROL (3) [illegible]

OWNERSHIP (4)

NUMBER OF SERVICES / NUMBER OF METERS	LAB. CONTROL	SOURCE OF SUPPLY	SAFE YIELD IMPOUNDED MG / MAXIMUM DEPEND. DRAFT (GR. WATER) MG
5	6	7	8

(5) CLASSIFICATION	NUMBER OF SERVICES	NUMBER OF METERS	MGD AVG. WATER
RESIDENTIAL d			
COMMERCIAL b			
INDUSTRIAL c			
PUBLIC d			
TOTAL e			

SOURCE OF SUPPLY (6)

SAFE YIELD IMPOUNDED, MG (7) a

MAXIMUM DEPENDABLE DRAFT (GR. WATER) MG (7) b

RATED PLANT CAPACITY MGD / ALTERNATE PLANT CAPACITY MGD	TREATMENT	DISTRIBUTION STORAGE / PUMPED TO MAINS	IMPROVEMENTS NEEDED
9	10	11	12

RATED CAPACITY MGD (8) a / AVERAGE (8) b DAILY MGD / EMERGENCY PEAK (8) c	TREATMENT (9) a	DIST. STORAGE: PUMPED TO MAINS MG (10) a / GRAVITY TO MAINS MG (10) b	IMPROVEMENTS NEEDED (11)

REMARKS

MUNICIPAL WATER SUPPLY SANITARY SURVEY

Exp. March 1970

SURVEY DATE

1. Leave this blank (for office use on 12 (DUP. ON EVERY CARD)) Date of survey: 13 mo. day yr.

2. Name of supply. Same as on inventory

3. Location Same as on inventory
post office common name, if different

4. Demands, MGD:

	PRESENT	10-YR. ESTIMATE	UNKNOWN
A. Avg. day	Blank (32–35)	(24–28)	(50)
B. Max. day	Blank (31–35)	(36–40)	(42)
C. Max. month	Blank (35–39)	(48–52)	(54)

5. Water use has been restricted [ ] [ ] (23–24) times for a total of [ ] [ ] [ ] (57–59) days during any one year of the past 5 years.

6. LABORATORY CONTROL

A. Bacteriological (Distribution system only)

(1) Min. number samples recommended per month by PHS DWS → From Eng. to DW. (60–62) UNKNOWN

(2) Avg. number/month for last 12 months — May be: (63–65)

(3) Range of least and most monthly samples — from [ ] [ ] (66–70) to [ ] [ ] (71–75) UNKNOWN

(4) Number of months the Drinking Water Standards were not met during the last 12 months for: END CARD ONE (80) No. of months UNKNOWN

(a) Quality — See 3.2 - D.W.S. (10–12)

(b) Number of samples — Months when sample (number) < no. in Stds. (16–17)

(c) NONE collected — No samples for ___ months. (20–21)

(5) Are samples representative of distribution system? Judge from maps of distribution system. [ ] yes (23) [ ] no

(6) Are check samples collected as provided for in the Drinking Water Standards? See 3.15 - D.W.S. [ ] yes (24) [ ] no

(7) Are samples requiring check samples reported by telephone? [ ] yes (26) [ ] no (27)

(8) Is the laboratory certified? [ ] yes (28) [ ] no (29)

(a) Within the past 3 years? From operator [ ] yes (30) [ ] no (31)

(b) If answer to one or both, by whom was it certified. [ ] State (37) [ ] Local (38)

(9) Are samples received by lab within 30 hours? [ ] yes (34) [ ] no (35)

ECA-19

51

B. Chemical (finished water only)

(1) Samples of finished water are analyzed each [ ] 36 month, [ ] 37 year, [ ] 38 2 years, [6] 39 3 years, [ ] 40 infrequently [ ] 41 never.

(2) Type of analysis: [ ] 42 complete (EHS) [ ] 43 partial. If any exclusions were made, explain.

(3) Date of last chemical analysis [ ][ ] 45 mo. [ ][ ] day [ ][ ] yr 46

(4) Analyzed by [ ] 51 utility, [ ] 52 state, [ ] 53 PHS, [ ] 54 university, [ ] 55 other.

(5) Tests run for operational control and their frequency are:

Tests	Frequency				
	Continuous	Each shift	Daily	Weekly	Less frequently than weekly
Alkalinity	[ ] 57	[ ]	[ ]	[ ]	[ ] 61
Aluminum	[ ] 62	[ ]	[ ]	[ ]	[ ] 66
Chloride	[ ] 67	[ ]	[ ]	[ ]	[ ] 71
Chlorine residual	[ ] 72	[ ]	[ ]	[ ]	[ ] 76
(END CARD TWO) [2] 80					
Color	[ ] 73	[ ]	[ ]	[ ]	[ ] 77
Fluoride	[ ] 10	[ ]	[ ]	[ ]	[ ] 14
Hardness	[ ] 15	[ ]	[ ]	[ ]	[ ] 19
Iron	[ ] 20	[ ]	[ ]	[ ]	[ ] 24
Jar tests	[ ] 23	[ ]	[ ]	[ ]	[ ] 27
Manganese	[ ] 28	[ ]	[ ]	[ ]	[ ] 32
pH	[ ] 33	[ ]	[ ]	[ ]	[ ] 37
Taste & Odor	[ ] 38	[ ]	[ ]	[ ]	[ ] 42
Turbidity	[ ] 43	[ ]	[ ]	[ ]	[ ] 47
Zeta potential	[ ] 48	[ ]	[ ]	[ ]	[ ] 52
Other _____	[ ] 53	[ ]	[ ]	[ ]	[ ] 57

C. Radioactivity

(1) Samples are analyzed each [ ] 69 month, [ ] 70 year, [ ] 71 2 years, [ ] 72 3 years, [ ] 73 infrequently [ ] 74 never. (END CARD 3) [3] 80

(2) Date of last radiological analysis [ ][ ] 15 mo. [ ][ ] day [ ][ ] yr 18

(3) Analyzed by [ ] 19 utility, [ ] 20 state, [ ] 21 PHS, [ ] 22 university, [ ] 23 other.

7. SANITARY SURVEY

A. Date of most recent survey [ ][ ] mo. [ ][ ] day - [ ][ ] yr. 29 of [ ] 30 none

B. Survey made by: [ ] 31 state, [ ] 32 PHS, [ ] 33 local health department, [ ] 34 utility, [ ] 35 consultant. "Survey" requires written report of findings

C. Facilities surveyed: [ ] 36 source, [ ] 37 transmission, [ ] 38 treatment, [ ] 39 storage, [ ] 40 distribution.

8. FACILITIES & OPERATION (describe deficiencies on reverse side)

	YES	NO
A. Are there common walls between finished and lesser quality water?	[ ] 41	[ ] 42
B. Are there inter-connections to other "systems" "Sub-divisions, private industrial, commercial, indicated by state health dept acceptance.		
(1) of known acceptable quality	[ ] 43	[ ] 44
(2) of unknown quality		
(a) with protection Note how protected	[ ] 45	[ ] 46
(b) without protection	[ ] 47	[ ] 48
C. Is there a cross-connection control program		
(1) on new construction only	[ ] 49	[ ] 50
(2) for continuous re-inspection	[ ] 51	[ ] 52
D. Are finished water reservoirs properly covered?	[ ] 53	[ ] 54
E. Is there detectible chlorine residual in distant parts of the distribution system?	[ ] 55	[ ] 56
F. Can the treatment plant be by-passed?	[ ] 57	[ ] 58
G. Are there satisfactory procedures to:		
(1) prevent personal accidents	[ ] 59	[ ] 60
(2) prevent chlorine accidents	[ ] 61	[ ] 62
(3) disinfect all new and/or repaired distribution system mains, valves, fittings, including check samples before being placed in service?	[ ] 63	[ ] 64
H. Are there areas of low pressure (< 20 psi) in the distribution system under maximum water use?	[ ] 65	[ ] 66

I. Operating problems most often encountered are: [ ] 67 taste & odor [ ] 68 phenols, [ ] 69 corrosive water, [ ] 70 short filter runs, [ ] 71 other, specify.

8. FACILITIES & OPERATION, continued

J. Chlorination process was interrupted ☐☐ (72 73) times in the last 12 months.

(1) Interruptions were due to: ☐ (74) chlorinator failure, ☐ (75) feedwater pump, ☐ (76) changing cylinders, ☐ (77) power failure, ☐ (78) other, explain. (END CARD 4) 4 (80)

K. Percent of land area within service area where water is available (nearest whole percent) ☐☐☐ (13 15) %.

L. Were plans and specs. for treatment plant approved by the state? YES ☐ (16) NO ☐ (17)

9. SOURCE, TREATMENT & DISTRIBUTION (describe deficiencies on reverse side) Neb.

A. Are the following adequate:

	YES	NO
(1) Source, with respect to the following:		
(a) quantity	☐ (18)	☐ (19)
(b) bacteriological quality	☐ (20)	☐ (21)
(c) chemical quality	☐ (22)	☐ (23)
(d) physical quality	☐ (24)	☐ (25)
(e) adequate protection	☐ (26)	☐ (27)
(2) Transmission of raw water	☐ (28)	☐ (29)
(3) Is the raw water sampled for:		
(a) Bacteriological contamination	☐ (30)	☐ (31)
(b) Chemical contamination	☐ (32)	☐ (33)
(4) Treatment, with respect to the folowing:		
(a) aeration	☐ (34)	☐ (35)
(b) chemical feed, capacity	☐ (36)	☐ (37)
(c) chemical feed, stand-by equipment	☐ (38)	☐ (39)
(d) chemical mixing	☐ (40)	☐ (41)
(e) flocculation	☐ (42)	☐ (43)

Refer to PWS No. 1080

9. SOURCE, TREATMENT & DISTRIBUTION, continued

A. Are the following adequate (continued):

	YES	NO
(4) Treatment, continued:		
(f) settling	44	45
(g) recarbonation	46	47
(h) filtration At normal operating rates	48	49
(i) disinfection, capacity	50	51
(j) disinfection, stand-by equipment	52	53
(k) taste & odor control	54	55
(l) fluoridation	56	57
(5) Distribution, with respect to the following:		
(a) storage	58	59
(b) booster chlorination	60	61
(c) high service pumping	62	63
(d) booster pumping	64	65
(e) pressure	66	67
(6) Maintenance	68	69
(7) Records for:		
(a) disinfection	70	71
(b) filter runs	72	73
(c) chemical consumption	74	75
(d) operational control tests	76	77
(e) bacteriological examinations	78	79
(8) Cross-connection control	END CARD 5	5/10
(a) ordinance	14	15
(b) program implementation	16	17
(c) progress	18	19

<55<

9. SOURCE, TREATMENT & DISTRIBUTION, continued

B. During the past 3 years, raw water quality has ☐ 19 improved, ☐ 20 deteriorated, or ☐ 21 stayed the same.

10. PERSONNEL

A. Water Purification Operator This is the responsible plant operator - Not supt.

(1) Highest level of formal education: ☐ 22 8th grade or less, ☐ 23 high school, ☐ 24 technical or trade school, ☐ 25 university.

(2) Level of training in water treatment: ☐ 26 college course, ☐ 27 technical or trade school, ☐ 28 short school, ☐ 29 on the job, ☐ 30 none, ☐ 31 other, specify _____.

(3) Length of time on this job: ☐☐ 32 33 years, ☐☐ 34 35 months.

(4) Number of previous positions as water treatment operator ☐☐ 36 37

(5) Total years of water purification experience ☐☐ 38 39

(6) Level of study in sanitary microbiology: ☐ 40 college course, ☐ 41 technical or trade school, ☐ 42 short school, ☐ 43 on the job, ☐ 44 none, ☐ 45 other, specify _____.

(7) Level of study in water chemistry: ☐ 46 college course, ☐ 47 technical or trade school, ☐ 48 short school, ☐ 49 on the job, ☐ 50 none, ☐ 51 other, specify. _____.

(8) Is the operator a full-time employee? ☐ 52 yes ☐ 53 no

(9) Salary range (per year) of operator: ☐ 54 <$1,999 ☐ 55 $2,000-4,999 ☐ 56 $5,000-7,499 ☐ 57 $7,500-9,999 ☐ 58 $10,000

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10. PERSONNEL, continued

A. continued

(10) Is your present staff adequate in: Operator's opinion

(a) number ☐ yes (60) ☐ no (61)

(b) quality ☐ yes (62) ☐ no (63)

B. Operator's major complaint _____

C. Most frequent customer's complaint: Received by utility.

D. Management's most frequent complaint: _____

11. FINANCIAL INFORMATION

A. Bonded indebtedness: (water supply)

(1) General obligation bonds $ [ ][ ][ ][ ][ ][ ][ ][ ]. END CARD 6 [6] 80

(a) statutory limit $ [ ][ ][ ][ ][ ][ ][ ][ ].

(2) Revenue bonds $ [ ][ ][ ][ ][ ][ ][ ][ ].

(a) statutory limit $ [ ][ ][ ][ ][ ][ ][ ][ ].

B. Capital stock, par value $ [ ][ ][ ][ ][ ][ ][ ][ ].

bonds, par value $ [ ][ ][ ][ ][ ][ ][ ][ ].

C. Water funds are [ ] 53 kept separate or [ ] 54 mingled with other funds.

D. Is there an annual payment to the general fund? [ ] 55 yes [ ] 66 no

E. Operation is controlled by: [ ] 57 mayor-council, [ ] 58 mayor-commission, [ ] 59 independent water board, [ ] 60 other, specify. _____

For city, district, etc. owned only

F. Is there active planning for expansion or improvement? [ ] 61 yes [ ] 62 no

(1) Value of planned improvement $ [ ][ ][ ][ ][ ][ ][ ][ ].

(2) Planning by utility [ ] 71 yes [ ] 72 no utility only

(3) Planning by consultants [ ] 73 yes [ ] 74 no utility & consultants

END CARD 7 [7] 80

G. If expansion is planned, it will be carried out within:

	1 YR.	2-5 YRS.	6-10 YRS.
(1) Source	[ ] 13	[ ]	[ ] 15
(2) Treatment	[ ] 16	[ ]	[ ] 18
(3) Distribution	[ ] 19	[ ]	[ ] 21
(4) Other _____	[ ] 22	[ ]	[ ] 24

H. Costs of production:

CENTS/1,000 GALLONS

(1) Chemicals [ ][ ].[ ] 29 30

(2) Labor, power, etc. [ ][ ].[ ] 31 32

(3) Depreciation [ ][ ].[ ] 33 34

(4) Other, including office, administration, meter reading, collection, etc. [ ][ ].[ ] 35 37

(5) Total [ ][ ].[ ] 38 40

11. FINANCIAL INFORMATION, continued

1. Tariff (Residential)

(1) Connection fee $ [ ][ ][ ][ ]. (41–44)

(2) Sales unit is [ ] (45) per 1,000 gallons or [ ] (46) per 100 cu. ft.

(a) [ ][ ][ ] (47) cents for the first [ ][ ] (50–51) units

(b) [ ][ ][ ] (52) cents for the next [ ][ ] (55–56) units

(c) [ ][ ][ ] (57) cents for the next [ ][ ] (60–61) units

(d) etc. as needed to cover steps.

Adjust all rates to these units.

END CARD 8 [8]

Note flat rate here as $/(59) (60) time unit

BUREAU OF WATER HYGIENE

PUNCH IN COL.

IDENTIFICATION OF WATER SAMPLE

1. LOCATION OF WATER SUPPLY Same as on inventory
CITY, COUNTY, STATE

FOR OFFICE USE ONLY

2. WATER SUPPLY NAME Same as on inventory

3. DATE OF SAMPLING — BEGINNING DATE OF COMPOSITE MO. DAY — ENDING DATE OF COMPOSITE OR DATE OF GRAB SAMPLE MO. DAY YR.

4. SAMPLE FROM — ☐ TREATMENT PLANT (8) ☐ WELL (4) ☐ RESERVOIR (2) ☐ DISTRIBUTION SYSTEM (1) ☐ OTHER (0) ☐

5. SAMPLING POINT LOCATION AND OR DESCRIPTION ie. kitchen, 1234 Main ☐

6. TYPE OF WATER SAMPLED — ☐ FINISHED (8) ☐ PARTIALLY TREATED (4) ☐ RAW (2) ☐ OTHER (0) ☐

7. SOURCE OF WATER — ☐ SURFACE (8) ☐ GROUND (4) ☐ COMBINED (2) ☐ OTHER (0) ☐

8. SAMPLING METHOD — ☐ COMPOSITE (8) ☐ GRAB (4) ☐ OTHER (0) ☐

9. ANALYSIS REQUIRED — ☐ ORGANIC (8) ☐ TRACE ELEMENTS (4) ☐ WET (2) ☐ RADIO-CHEMICAL (1) ☐ OTHER (0) ☐

10. WATER SUPPLY CATEGORY — ☐ COMMUNITY WATER SUPPLY (8) ☐ NSWS (4) ☐ FEDERAL INSTALLATION (2) ☐ SPECIAL STUDY (1) ☐ OTHER (0) ☐

11. APPEARANCE OF SAMPLE _____

12. ADDITIONAL REMARKS _____

13. COLLECTED BY _____ ☐ PWS NUMBER ☐ OTHER ☐

DO NOT WRITE BELOW THIS LINE

LAB. SAMPLE NO. _____ DATE RECEIVED _____

LABORATORY REMARKS

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SEE EGA INSTRUCTIONS

INSTRUCTIONS: EVERY ITEM OF INFORMATION REQUIRED FROM THE SAMPLER IS NUMBERED (1 THROUGH 13). THESE ARE THE ONLY RESPONSES THE SAMPLER SHOULD MAKE. NOTE AREAS MARKED "DO NOT WRITE BELOW THIS LINE" AND "FOR OFFICE USE ONLY."

ITEM 1 SHOULD BE THE LOCATION OF THE WATER SUPPLY FACILITY WHICH PRODUCED THE WATER FOR THE SAMPLE. (EXAMPLE: CINCINNATI, HAMILTON, OHIO.)

ITEM 2 SHOULD BE THE FULL NAME OF THE WATER SUPPLY FACILITY. (EXAMPLE: CINCINNATI MUNICIPAL WATER WORKS)

ITEMS 4, 6, 7, AND 8 - CHECK THE BOX WHICH APPLIES

ITEMS 9 AND 10 - CHECK ONE OR MORE BOXES AS NECESSARY

ITEMS 3, 5, 11, 12, AND 13 SHOULD BE SELF-EXPLANATORY

ANY RESPONSE OF "OTHER" OR "SPECIAL STUDY" SHOULD BE EXPLAINED UNDER ITEM 12 - ADDITIONAL REMARKS.

IF NECESSARY FOR COMPLETE IDENTIFICATION OR EXPLANATION, PLEASE FEEL FREE TO USE THE BACK OF THE ORIGINAL (WHITE) COPY OR ATTACH AN ADDITIONAL PAGE OF LIKE SIZE.

DISTRIBUTION:

MAIL ORIGINAL (WHITE COPY) TO:

WATER QUALITY REGISTER BRANCH
BUREAU OF WATER HYGIENE
222 E. CENTRAL PARKWAY
CINCINNATI, OHIO 45202

BLUE	ENCLOSED WITH ORGANIC SAMPLE
PINK	ENCLOSED WITH TRACE METAL SAMPLE
YELLOW	ENCLOSED WITH WET CHEMISTRY SAMPLE
GREEN	ENCLOSED WITH RADIOCHEMICAL SAMPLE
TAN	RETAINED BY REGIONAL OFFICE OR SAMPLER

ENVIRONMENTAL CONTROL ADMINISTRATION

BUREAU OF WATER HYGIENE

PUNCH IN COLS. 1 6

IDENTIFICATION OF WATER SAMPLE

1. LOCATION OF WATER SUPPLY _____
CITY, COUNTY, STATE

FOR OFFICE USE ONLY ☐☐☐☐☐☐☐☐☐☐☐☐ (7–18)

DO NOT WRITE BELOW THIS LINE

2. WATER SUPPLY NAME _____

3. DATE OF SAMPLING — BEGINNING DATE OF COMPOSITE MO. ☐☐ DAY ☐☐ (19–22); ENDING DATE OF COMPOSITE OR DATE OF GRAB SAMPLE MO. ☐☐ DAY ☐☐ YR. ☐☐ (23–28)

4. SAMPLE FROM — ☐ TREATMENT PLANT (8) ☐ WELL (4) ☐ RESERVOIR (2) ☐ DISTRIBUTION SYSTEM (1) ☐ OTHER (0) ☐ (29)

5. SAMPLING POINT LOCATION AND/OR DESCRIPTION _____ ☐☐ (30–31)

6. TYPE OF WATER SAMPLED — ☐ FINISHED (8) ☐ PARTIALLY TREATED (4) ☐ RAW (2) ☐ OTHER (0) ☐ (33)

7. SOURCE OF WATER — ☐ SURFACE (8) ☐ GROUND (4) ☐ COMBINED (2) ☐ OTHER (0) ☐ (34)

8. SAMPLING METHOD — ☐ COMPOSITE (8) ☐ GRAB (4) ☐ OTHER (0) ☐ (35)

9. ANALYSIS REQUIRED — ☐ ORGANIC (8) ☐ TRACE ELEMENTS (4) ☐ WET (2) ☐ RADIO-CHEMICAL (1) ☐ OTHER (0) ☐ (36)

10. WATER SUPPLY CATEGORY — ☐ COMMUNITY WATER SUPPLY (8) ☐ ICWS (4) ☐ FEDERAL INSTALLATION (2) ☐ SPECIAL STUDY (1) ☐ OTHER (0) ☐☐ (37–38)

11. APPEARANCE OF SAMPLE _____

12. ADDITIONAL REMARKS _____

13. COLLECTED BY _____ ☐ USPHS STAFF ☐ OTHER ☐ (1) (80)

DO NOT WRITE BELOW THIS LINE

LAB. SAMPLE NO. _____ DATE RECEIVED _____

LABORATORY REMARKS

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FOR INSTRUCTIONS

GLOSSARY

Back Flow -- The flow of water or other liquids, mixtures, or substances into the distributing pipes of a potable supply of water from any source or sources other than its intended source. Back siphonage is one type of backflow.

Back Flow Connection -- Any arrangement whereby backflow can occur.

Back Siphonage -- The flowing back of used, contaminated, or polluted water from a plumbing fixture or vessel or other sources into a water supply pipe due to a negative pressure in such pipe.

Bad sample -- A bacteriological sample that showed the presence of coliform bacterial contamination.

Consumer -- One person using the water for domestic and culinary purposes.

Cross Connection -- Any physical connection or arrangement between two otherwise separate piping systems, one of which contains potable water and the other either water of unknown or questionable safety, or steam, gas, or chemical, whereby there may be a flow from one system to the other, the direction of flow depending on the pressure differential between the two systems. See Backflow and Back siphonage.

Fecal Coliform Bacteria -- That portion of the total coliform population which are capable of lactose fermentation at an elevated temperature of 44.5°C. Unlike some strains of the non-fecal members of the total coliform group, fecal coliforms have a specific high order of positive correlation with warm-blooded animal pollution, survive for a shorter time in water and soil, and more closely correlate with survival patterns of enteric pathogenic bacteria.

Good Sample-- A bacteriological sample that did not show the presence of coliform bacterial contamination.

Inter-Connection -- A connection between the water supply and one or more additional sources of water not under the jurisdiction or control of the water supply operator.

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Mandatory Limit -- The upper limit of density of coliform bacteria as described in Section 3.23, as modified below, of the concentration of certain ions as described in Section 5.22 and 5.23 and of radioactivity as described in Section 6.22, Public Health Service Drinking Water Standards, 1962 (PHS Publication No. 956). For these samples collected for this study, the bacterial limit was exceeded if the arithmetic average was more than 1 coliform per 100 ml. Also, for this study the total chromium concentration was considered to be hexavalent chromium.

Persons Served -- The aggregate number of consumers.

Plate Count --A measure of the general bacterial population present in the water sample as described in Standard Methods for the Examination of Water and Wastewater, 12th Ed. These bacteria will produce colonies on plate count agar in 48 hours when incubated at 35 C. (95 F.).

Recommended Limit -- The upper limit of concentration of turbidity, color, chemicals, and radioactivity as described in Sections 4.2, 5.21, and 6.21, PHS Drinking Water Standards 1962 (PHS Publication No. 956).

Responsible Operator -- The operator at the treatment plant responsible for the day to day operation of the treatment facilities. Where there is no treatment, the person responsible for the operation of the system.
He is not necessarily the water superintendent.

Service Connection -- A physical connection to a water main for the purpose of conveying water to a building or onto a premise for use.

Standard Metropolitan Statistical Area -- The boundaries and titles of standard metropolitan statistical areas are established by the Bureau of the Budget with the advice of the Federal Committee on Standard Metropolitan Statistical Areas. This Committee is composed of representatives of the major statistical agencies of the Federal Government. In applying the following criteria, data from the following sources are used by the Committee:

Population, labor force, density, and occupational data: Bureau of the Census and Bureau of Employment Security.

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